

# Key informant perceptions of challenges and facilitators to implementing passive remote monitoring technology for home care clients

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## Abstract

**Background:** Passive remote monitoring technologies (RMT) are an option that could keep frail older adults home longer while reducing care burdens on family/friend caregivers. In contrast to active RMT which requires an individual to engage with the technology (i.e., push a button), passive RMT does not require any action to function (i.e., sensors or cameras).

**Objective:** This qualitative study explored the challenges and facilitators of implementing passive RMT in home care settings by applying an implementation science lens.

**Method:** Twenty semi-structured interviews were conducted with key informant stakeholders. Data were coded using a Framework Analysis approach that inductively and deductively coded transcripts. The analysis applied deductive codes based on the implementation science framework, the Consolidated Framework for Implementation Research (CFIR). Inductive coding ensured that the participants' perspectives were represented.

**Results:** Although participants perceived passive RMT was beneficial, there were health system policies that made it hard for practitioners to share information on passive RMT with home care clients; thus, home care clients and their caregivers, who may not have the digital literacy to determine which RMT are suitable for the situation, were tasked with determining which RMT was suitable.

**Conclusion:** Applying an implementation science lens helped identify what institutional barriers need to be addressed to integrate passive RMT into home care for older adults. The findings highlight the need to educate practitioners and policymakers on when passive RMT is appropriate for home care clients. Disseminating information on passive RMT to older adults and their families could increase their awareness and facilitate decision-making.

**Keywords:** home care, older adults, passive remote monitoring, family and friend caregiver, implementation, Canada

## INTRODUCTION

In Canada and elsewhere, aging populations want to be supported to remain in their homes (Pani-Harreman et al., 2021). This has led to a growing demand for home care services (Statistics Canada, 2022). Home care plays a key role in supporting older adults to live well longer at home. In Canada, health care is funded by the federal government and regulated by individual provincial and territorial governments (Government of Canada, 2023). Unlike acute care that is provided in hospitals, home care is not fully funded by the federal government (Government of Canada, 2016). Home care services are comprised of specialized medical care and non-medical home support services provided by regulated and non-regulated health care professionals. The amount of public funds available for home care

services varies depending on region, income, and family size. Often additional private funds are necessary to cover home care services not covered by public funds (Marchildon et al., 2021).

Although there is a substantial need for home care there are often challenges to recruiting and maintaining home care staff, who work in an underfunded sector of the healthcare system (Yakerson, 2019). Studies have shown that 25% of Canadian older adults receive only some of the home care services they require, leading to unmet patient care needs and increased potential for further health decline requiring institutionalized care (Johnson et al., 2018).

To offset limited home care services, family/friend caregivers often support older adults to

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remain at home. Many older adults would not be able to remain at home if they did not have support from their family/friends and caregivers (Ris et al., 2019). However, this care comes at a financial (Moody et al., 2022) and emotional cost. Without additional support, caregiver burden can create untenable situations where family/friend caregivers are no longer able to provide the care necessary to keep the older adult living at home (Riffin et al., 2019). One supportive care strategy being considered is the use of remote monitoring technology (RMT) in the home.

RMT acts by sending notifications from sensors (e.g., motion sensors, cameras, medication administration monitoring) to a recipient, such as a caregiver or health professional. RMT is often classified as either active RMT, which requires user participation such as pushing a button on a pendant alarm, or passive RMT which involves sensors not requiring any action by the user for the system to work (Sixsmith, 2000). Passive RMT uses sensors in the home to detect potential emergencies and transmits information to a caregiver or care provider who can monitor older adults' activities and safety in the home.

Existing research on the benefits of using passive RMT among older adults is diverse, making a synthesis of the evidence difficult. There is some evidence that passive RMT increases the safety of the older adult who is living at home (Read, Weeks, et al., 2022). In addition, it may reduce family/friend caregiver stress by increasing the caregiver's feeling that the older adult is secure (Mitchell et al., 2020). To add to the current literature a mixed methods pragmatic randomized controlled trial (PRCT) was conducted by this research group to examine whether providing passive RMT to frail older adults receiving home care services was effective at keeping them home longer. The trial was conducted in two Canadian provinces, Ontario and Nova Scotia. For additional details on the methodology of that study see the published protocol (Donelle et al., 2020). The data from this trial is currently being analyzed.

To complement data from the trial the research group conducted additional qualitative studies to triangulate the perspectives of different stakeholders and settings. The first qualitative study (Read, Gagnon, et al., 2022) was conducted in the Canadian province of New Brunswick, where passive RMT is an eligible expense for publicly funded home care. Findings from this study indicated home care clients and caregivers believed passive RMT supported older adults to live at home longer and provided caregiver relief. Care providers and decision makers included in this study also shared a range of opinions about which clients benefited most from passive RMT

and what role case managers should play in informing clients and caregivers about the service. The second qualitative study (Weeks et al., 2022) was conducted with family/friend caregivers in the Nova Scotia arm of the PRCT. This study highlighted the ability of passive RMT to help caregivers identify and prevent negative situations and adverse health events for the home care recipient, leading to what caregivers perceived as improvement in their overall well-being.

Evidence of intervention efficacy is often not enough to stimulate the implementation of innovations like passive RMT. The field of implementation science has accumulated knowledge and established theories and frameworks that identify factors at multiple levels including personal capabilities and beliefs, organizational settings, and policy levels that interact to affect whether innovations are successfully implemented and spread into local contexts (Damschroder, 2019). Implementation research projects apply knowledge from these theories and frameworks to identify what facilitates or hinders the successful implementation of an innovation, and secondly what strategies can be used to increase its adoption in a practice setting (Nilsen, 2015).

The purpose of this current qualitative study was to apply an implementation science framework to explore the multi-level barriers and facilitators that could affect the implementation of passive RMT into homecare settings from the perspectives of key informant stakeholders from Nova Scotia Canada. The research question we explored was: How do key informant stakeholders perceive the barriers and facilitators to implementing passive RMT among older homecare service recipients?

## METHODS

### Study design and context

A qualitative descriptive study (Doyle et al., 2020) was conducted to address the research question. The context of the study was home care services in Nova Scotia Canada. The Canadian government funds the Nova Scotia Department of Seniors and Long-Term Care (sets public health policy) and Nova Scotia Health (provides health services and programs) to deliver home care through individual Care Coordinators. The Coordinators assess home care clients and determine their need for home care services, agencies outside the health system are contracted to provide home care services (Nova Scotia Dept of Health and Wellness, 2020). There are no out-of-pocket costs for receiving skilled nursing home care services, however, fees for home support (e.g., light housekeeping, laundry, meal preparation) are based on income and family size, and additional supports may include covering costs such as specialized equipment loans (Nova Scotia Dept

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of Health and Wellness, 2020). Recent statistics show that Nova Scotia has the highest proportion of adults sixty-five and older in Canada (21.3%) (Statistics Canada, 2020) in addition to some of the highest rates of one or more chronic conditions (69%) (Statistics Canada, 2020) and percent disability (43%) (Statistics Canada, 2018). Compared to Canada as a whole, Nova Scotians 65 and older have higher rates of disabling chronic conditions such as arthritis (52% versus 46%), heart disease (17% versus 15%) and Alzheimer's disease (3% versus 2%) (Statistics Canada, 2021). Twenty-two percent of Nova Scotians received assistance from family/friend caregivers for a health problem in the last 12 months, compared to fifteen percent in Canada (Statistics Canada, 2021). These factors combine to create a substantial need for home care in the province. Currently, Nova Scotia does not offer passive RMT to their publicly funded home support clients.

## Participants

Key informant stakeholders were sampled based on their knowledge of the health system and community context that would affect the implementation of passive RMT in homecare settings. They included: policymakers (provincial government employees with the authority to make policy decisions regarding home care services); home care managers (managers for front-line home care workers); home care staff who coordinated (provincial Care Coordinators) or provided direct patient care (front line workers providing care to home care clients); resource navigators (non-profit organization employees who connected home care clients with services); and RMT service providers (employees of companies providing RMT). This array of participants provided a variety of perspectives on the individual, organizational, and health system factors that could affect the implementation of passive RMT in homecare settings. Partners involved with the PRCT agreed to help identify potential participants who would have knowledge of RMT or home care services. Snowball sampling was used when insights on a topic were identified during an interview, but the participant did not have adequate knowledge in that area to elaborate on the topic. In these circumstances, the participant was asked to recommend another informant who had firsthand information on the topic. When the participant could not provide a recommendation, contact information was gathered from public websites. Researchers sent all potential participants an information letter by email and verbal informed consent was obtained before each interview.

## Ethical considerations

An ethics certificate was received from the Nova Scotia Health Research Ethics Board (File #1022203). Prior to each interview, informed

consent was obtained either verbally or in writing. Audio-recorded interviews were saved using a study ID number on a secure password-protected and encrypted computer server at Dalhousie University. Participants were advised not to disclose any identifying information, but if identifying information was disclosed, it was not included in the interview transcript. A confidentiality agreement was signed by anyone who had access to the data, including a professional transcriber. Quotes from participants are identified by their interview number only.

## Theoretical framework

Data collection and analysis were guided by the Consolidated Framework for Implementation Research (CFIR 1.0) to facilitate the identification of multi-level factors that could affect the implementation of RMT in homecare. The CFIR was chosen because it assesses multi-level factors that affect the successful implementation of an intervention (McLssac et al., 2018). CFIR is a determinant implementation framework composed of evidence-based constructs that (1) help to predict or explain implementation outcomes and (2) are designed to capture the perceptions of individuals who can impact implementation success (Damschroder et al., 2022). CFIR has 39 constructs organized into five major domains found to influence the successful implementation of innovative programs (*Table 1*). CFIR domains aligned with the following attributes of the study: passive RMT (Intervention characteristics), provincial health system (Outer setting), homecare service organizations (Inner setting), health professionals and managers involved in implementing passive RMT (Characteristics of individuals), and the process of implementing passive RMT (Process). Individuals were sampled to provide key informant perspectives on the multi-level factors affecting RMT implementation. These multi-level factors aligned with CFIR domains.

## Data collection

Data were collected through individual semi-structured interviews using interview guides tailored to participants. The content of the questions asked in the different interview guides is summarized in *Table 2*. Questions were informed by CFIR to ensure perceived contextual barriers and facilitators at multiple levels (health system, community, and home care contexts) were explored. In addition, participants were asked about the benefits and limitations of RMT to understand how their personal beliefs may influence future implementation. At the end of each interview, all stakeholders were invited to make additional comments and provide demographic information (e.g., gender, age, years of experience, and professional degree/highest level of education).

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Table 1. Consolidated Framework for Implementation Research (CFIR) domains and constructs and their alignment with barriers and facilitators to implementing Passive Remote Monitoring Devices (RMT)

Domains	Constructs	Barrier or facilitator
<b>1. Intervention characteristics, passive RMT characteristics</b>	• Intervention source	
	• Evidence strength and quality	B
	• Relative advantage	F
	• Adaptability	
	• Trailability	B
	• Complexity	
<b>2. Outer setting, health system and community contexts</b>	• Design quality and packaging	B&F
	• Cost	
	• Patient needs and resources	F
	• Cosmopolitanism	B
<b>3. Inner setting, homecare setting context</b>	• Peer pressure	B
	• External policy and incentives	
	• Structural characteristics	
	• Networks and communication	
<b>4. Characteristics of Individuals, and stakeholders involved in implementing passive RMT</b>	• Culture	
	• Implementation climate (Tension for change Compatibility, Relative priority, Organizational incentives & rewards, Goals and feedback, Learning climate	
	• Readiness for implementation (Leadership engagement, Available resources)	B
	• Access to knowledge and information	
	• Knowledge and beliefs about the intervention	F&B
	• Self-efficacy	B
<b>5. Process, process of implementing passive RMT</b>	• Individual stage of change	
	• Individual identification with organization	
	• Other personal attributes	
	• Planning	
	• Engaging (Opinion leaders, Formally appointed internal implementation leaders, Champions, External change agents)	B
	• Executing	
	• Reflecting and Evaluation	

## Data analysis

All interviews were conducted by phone with the same researcher. The researcher had training in qualitative interviewing skills and over ten years of experience conducting interviews. The research team consisted of researchers with experiences in both qualitative and quantitative research skills from both Nova Scotia and Ontario. The Nova Scotia research team met on a regular basis to discuss insights and suggest areas that needed further exploration in subsequent interviews. Interviews were audio recorded and transcribed by a professional transcriber verbatim. Transcripts were validated for accuracy by the researcher who originally conducted the interview. Any discrepancies in the written transcript were edited by the researcher to ensure accuracy. All validated transcripts were uploaded into NVivo 12 (QSR International, 2022), software that aids in organizing and analyzing qualitative data.

Content analysis (Kynge, 2020), applying a Framework Analysis approach (Goldsmith, 2021) was used during the study to determine the applicability of CFIR domains and constructs. Content analysis categorizes the data into patterns. Framework Analysis is an iterative process that involves both a deductive and inductive process. As in most qualitative analyses, the analytic process began early, during initial data collection, to help determine when new information was no longer being generated from interviews. An initial round of coding was conducted by two researcher assistants who independently and inductively coded all 20 transcripts and then met with the research leads to discuss differences and come to a consensus. Random transcripts were also reviewed by lead researchers to further verify the coding reliability. When new concepts evolved during the initial coding snowball sampling was used to identify additional participants who could pro-

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Table 2. Semi-structured interview guide questions

Participant group	Decision makers and managers	Resource navigators, direct care providers, and technology providers with RMT experience	Resource navigators, direct care providers, and technology providers without RMT experience
<b>What was the same for each interview?</b>	Professional opinions and observations around the ability of RMT to keep older adults at home longer. At the end of each interview, all were provided the opportunity to make additional comments and provide demographic information (e.g., gender, age, years of experience, and professional degree/highest level of education).		
<b>What was different?</b>	Concerns around RMT; changes to RMT that would be more useful for independent older adults and their family/friend caregivers; alternate types of technologies available; and possible policy developments around offering RMT to older adults.	Perceptions of the challenges (physical, emotional, etc.) experienced among RMT users and how these challenges could be addressed; the older adults' ability to acquire RMT; the older adult's ability to remain at home; the effect on caregiver's health or quality of life; and RMT factors associated with different living conditions (i.e., rural vs. urban, single dwelling vs. apartment living).	Whether RMT was a valuable service for older adults and their family/friend caregivers; possible concerns around RMT; and other types of technology that would be useful for older adults.

vide further insights, This was done to ensure the resulting themes fully represented participant-identified concepts, this is sometimes referred to as information power (Doyle et al., 2020).

A second round of inductive coding was completed by the lead researchers to identify more in-depth codes reflecting participants' intent. After the inductive coding, deductive codes based on CFIR constructs were identified to explicitly label factors related to implementation barriers and facilitators. This approach helped explore the applicability of CFIR domains and constructs. To guarantee findings conveyed the experiences of participants the following processes associated with rigorous qualitative research were enacted (Morse, 2015). A codebook was developed with clear definitions to ensure reliability across individuals coding the transcripts. All decisions on inductive and deductive codes were documented to create an audit trail. Reflexivity was practiced throughout the qualitative analysis between research group members to explore the credibility of the final themes. Multiple reviews of the coding were done to ensure themes reflected the voice and intent of participants. Finally, thick descriptions of the themes have been provided in the results to supply the reader with evidence of thematic summaries, and to assist with transferability of findings to other settings. Findings were reviewed by the Ontario research team members to check for personal or team biases and improve the rigor of the research.

## RESULTS

Twenty semi-structured telephone interviews were conducted from November 2019 to January 2021. Interviews ranged from 14-57 minutes with the mean interview being 32 minutes. Participants were 80% female, had a mean age of 47 (standard deviation=8.5), and a mean of 21 (standard

deviation=9.9) years of experience working in their profession. Participants were policymakers (PM) (n=4), home care managers (HCM) (n=4), direct care providers (DCP) (n=6), resource navigators (RN) (n=3), and technology providers (TP) (n=3). Educational levels varied; policymakers and managers primarily had a Master's or health professional degree (i.e., one was an occupational therapist), direct care providers were health professionals (i.e., social worker, nurse, occupational therapist) or certified home support workers, resource navigators and technology providers had Master's or Bachelor's degrees.

While the purpose of the study was to explore implementing passive RMT several informants were unable to comment specifically on passive RMT due to their lack of experience with the technology. The findings included interviewee's perspectives on both passive and active RMT and sometimes the broader umbrella term RMT was used in the themes if participants were talking generally about the technology. Findings were organized into four primary themes listed in Table 3. CFIR domains and constructs identified as barriers or facilitators in this study have been marked in Table 1.

### Theme 1: Perceived benefits and limitations of RMT Older adult and family/friend caregiver

The perceived benefits of both passive and active RMT to older adults and family/friend caregivers were intertwined and combined under one theme.

Participants were asked if RMT, both passive and active, helped keep the older adult home longer and out of long-term care. Most participants felt RMT helped keep the older adult home longer and out of long-term care, "...if they're able to take and extend someone's time in their home even comfortably by four months, six months,

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Table 3. Summary of themes and subthemes

Themes	Subthemes
Theme 1: Perceived benefits and limitations of RMT	1a) Older Adult and Family/friend caregiver 1b) Health care system
Theme 2: Awareness of, or ability to recommend RMT	
Theme 3: Health professionals will recommend RMT if they feel it is the 'right fit' for the client,	3a) RMT needs to be consistent with health professionals' perceived client goals of care 3b) Situations that may stimulate the adoption of RMT
Theme 4: Issues related to older adults or their family/friend caregiver issues related to RMT, Subtheme	4a) Clients or caregiver knowledge and comfort with technology 4b) RMT cost-shared with health systems or other agencies to make it more accessible.

twelve months, that is often a big advantage for family." (KI 9 – TP)

The reason often given for why RMT helped keep home care clients home longer was it reduced the risk of them having an adverse event, "If those devices weren't there, I feel that there were some [home care] clients that...would have been normally removed from their home because of the risk..." (KI 4 – HCM)

RMT "...allows people to respond faster when something goes wrong...And then outcomes are better..." (KI 11 – HCM)

One participant went so far as to say that, "people who were at home being monitored were obviously in some cases safer than those that were in long term care facilities." (KI 15 – RN)

The benefits of RMT to home care clients could subsequently lead to caregiver benefits. Participants across all categories mentioned the benefits to caregivers. RMT helped... "provide some assurance and comfort and confidence for the caregivers, especially that things are okay within the home...or... that they'll be made aware if things aren't going as they expect." (KI 6 – PM)

As one participant said, "You know, the forgotten discussion is always the caregiver burnout. We're always so inclined to talk about... how do we keep the seniors safe? But meanwhile, we've got caregivers who are burning out. And if they're burnt out then there's no one to look after mom and dad." (KI 18 – TP).

RMT could also help the caregiver sleep better or more generally "provide them in a way a bit of respite" (KI 1 – PM).

Another advantage is that RMT could also decrease their role as caregivers and enhance their family role because they could have "a real visit that provides a connection [to the care recipient] in a very different way than kind of going through a checklist" (KI 2 – PM).

Specific benefits of passive RMT mentioned that could mitigate caregiver stress were: video cameras that monitored the older adult, "...if you're away from the home... you know, something will hopefully get caught." (KI 11 – HCM); stove sensors that "...sets an alarm...if individuals decide that they need to cook... and if they're burning pots... it's a red flag for family members" (KI 4 – HCM); and bed sensors that notify the caregiver if the older adult was "...getting out of bed when they shouldn't be." (KI 11 – HCM)

Many participants felt RMT could reduce the number of home support services needed, "...a good option as opposed to hiring somebody privately to supplement whatever care they're getting through the public system..." (KI 1 – PM). This reduction in care providers coming into the home might increase the home care client's privacy, "And I've heard people talk about their experience with this kind of technology and saying, you know, I feel like I got some of my privacy back because I didn't have to have people always checking in on me or always with me" (KI 1 – PM). A related benefit was RMT may enhance the older adult's feeling of independence, "it really helps to promote their sense of independence that someone doesn't always have to physically be there in person to check in on them, that they can sort of go about their daily routine." (KI 3 – TP)

Limitations mentioned for active RMT were often due to the individual not remembering, or being unwilling, to wear the device..."And I've definitely seen many, many times you get in and they just simply don't have the device on. It's hanging on their bed or it's sitting at their kitchen table... Or just the folks that don't want to wear it and don't like to have it, shove it in a corner and, you know, put it on before their nurse comes" (KI 13 – DCP). Sometimes the home care clients did not engage the active RMT because they did not want to bother anyone, "There's times that people...have been on the floor for hours and the families have said they have one of those buttons, they didn't press it... Some of them will say, 'Well, I didn't want to bother anybody at 2:00 in the morning, so I just thought I'd wait until morning'" (KI 5 – DCP).

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In contrast to comments that RMT could increase home care clients' privacy, some felt passive RMT that involved having cameras in the home could impinge on the older adult's privacy. "... it is an invasion of privacy as much as it is a risk reducer..." (KI 8 – DCP). The privacy of the direct care provider was also mentioned, "if we're uncomfortable with being on a video surveillance, we have the right to cover those up while we're there..." (KI 17 – DCP).

## Health care system

The current crisis in-home care was remarked on by a range of participants. A resource navigator described the current situation in the province as, "...that there's...a few long-term care beds that are open, and it's so difficult to get in. And then seniors often land in the hospital and take up the hospital beds...and I know that there's a great deal of stress in terms of the number of... workers that are available...the homecare business or support has been very much challenged... homecare may be only able to provide you with two hours a day when really that senior requires more than those two hours." (KI 20 – RN). Also, a home care manager mentioned "...a lot of our challenges are on the human resource side of things...when we can't provide services because we're limited in capacity on human resources" (KI 11 – HCM). One of the technology providers felt that RMT just made sense, "... You've got...seniors who want to remain in their home. You've got caregivers who are burning out...there's just not enough personal support workers to be able to care for all of these aging seniors...The only way to keep them safe is to have technology." (KI 18 – TP).

Participants felt that a remotely monitored medication dispenser complemented home care services, and could keep home care clients in their homes longer and out of hospital, "...the use of a medication dispenser can actually reduce the number of nursing visits that might need to happen on any given day just for pill distribution." (KI 16 – PM)

"This was because... we have...nursing...to give our clients their medication because as [home support workers], we're not allowed to give people their medication. We can remind them, but that's as far as that can go." (KI 17 – DCP). In addition, it could keep the home care client home longer "...that client... was supported in his home much longer than anticipated... Because the reason why he would get readmitted [to hospital], have frequent admissions to the hospital, was because he was forgetting to take his medication." (KI 4 – HCM)

However, participants acknowledged there are limitations to how much RMT benefited the health system "...There comes a point where re-

mote monitoring can only do so much, and other... care solutions are needed. But I think in the interim, it's certainly a wise solution and appropriate use of resources." (KI 14 – RN). A further consideration mentioned was that RMT may increase health system costs if clients need support from home support staff to set up the technology "...if it creates additional visits or additional, you know, services that need to be piggybacked on to, you know, current budgets and all that kind of stuff, that could have an impact." (KI 11 – HCM)

## Theme 2: Awareness of, or ability to recommend RMT

Although several participants expected health-care providers would inform clients about passive RMT, policies (associated with discussing products from for-profit companies) limited what information they could share. "...because of conflict of interests and liability issues, we could no longer provide resource information to our clients..." (KI 4 – HCM). This left providers in the awkward position of not being "...allowed to make specific recommendations. But I will often give generalized information in terms of what types of products might be available." (KI 7 – HCM). To address this issue participants suggested that non-profit organizations post a resource list on their website that care providers could print off "...with the [non-profit organization] logo at the top, and...give that out...I'm not sure if it will pass the test. But...I'm not sure what else we're supposed to do." (KI 5 – DCP). Not having access to information on passive RMT from a trusted source meant home care clients and their caregivers usually relied on word of mouth from a friend or neighbour. "They can find out from friends and family. Like they, you know, the person may say, 'Oh, my cousin's mom or my aunt has this in place, and it works really well for her. So we wanted to look into it'." (KI 8 – DCP).

Many providers and policymakers did not have experience with passive RMT. A provider talked about their lack of exposure to the technology, "I don't believe I've seen many camera set-ups..." (KI 13 – DCP). However, providers and managers were aware of active RMT. One reason was a local non-profit home care agency provided access to active RMT "...we have the relationship with [RMT Provider], you know, we just...send them [home care clients] to [RMT Provider]" (KI 10 – HCM). Referring clients to a non-profit rather than a for-profit company appeared to avoid participants' conflict-of-interest concerns presented earlier.

The lack of health professional knowledge of passive RMT led several participants to recommend, "...providing education and opportunities for health-care workers who are working with families...making sure that people working in the system know

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*the full extent and the opportunities that these technologies have for people so that we can give good advice and incorporate that into whatever care plan we happen to be working on” (KI 1 – PM).*

### **Theme 3: Health professionals will recommend RMT if they feel it is the ‘right fit’ for the client**

*RMT needs to be consistent with health professionals’ perceived client goals of care*  
Many participants felt RMT needed to be tailored to the home care clients’ goals of care. For example, for some clients, passive RMT may increase social isolation, but for others, there could be positive *“...emotional aspects of being in your own home... it’s the right type of service for the abilities and capacity of the individuals that are using it and supporting it.”* (KI 11 – HCM). In addition, the family/friend caregiver’s situation needed to be considered such as whether *“...it would offload... responsibility from the caregivers that are already... experiencing caregiver breakdown or whether RMT fit with the ...different types of services and support that you’re able to offer caregivers...every caregiver’s situation is unique.”* (KI 6 – PM)

Regardless of the benefits of passive RMT to clients and their families, participants emphasized that it cannot be assumed *“... that everyone would rather be monitored than to...have an in-person care situation.... So that’s a decision that ideally the client who’s using the device should be making...Because oftentimes the compromise favours the risk tolerance of the caregiver. And I would like to see more of a discussion there for many people.”* (KI 12 – DCP). This perspective was shared by a technology provider *“...the user has to be wanting to use it. They have to be on board with it going in place.”* (KI 3 – TP). In addition, RMT is *“...not an inactive ingredient in the mix when someone is home...you don’t start something like that and forget about it. It should be reviewed...at regular intervals. Is this still working?... Are there any bad outcomes? ...Because people change...Especially if it’s a dementia. And something that can be awesome in one phase can be terribly triggering in another.”* (KI 12 – DCP)

*Situations that may stimulate the adoption of RMT*  
Situations that signal a home care client could benefit from RMT reflect disease processes such as dementia. *“... the common things that tend to happen when you have dementia, is that you will probably get lost or disoriented, you will probably have some trouble, you know, finding your way in familiar environments. So how do you want to handle it? Because one option is to not take the risk at all. Which is okay. But if you want to take the risk, here’s how you can mitigate that risk.... I encourage people to have those discussions early so that everyone knows...that some negotiation can happen about who’s comfortable with what,*

*who gets to say what the final decision will be, where the compromise will be.”* (KI 12 – DCP)

The benefits of RMT for individuals with dementia and their families were illustrated by one of the technology providers *“... we would put in the door sensors, we’d put in the motion sensors and the bed sensor. And, you know, it would act more like a security system...”* (KI 18 – TP). Medication reminders were helpful, *“if they find that the person with dementia is still having trouble maintaining or managing their medication...in many cases, remote monitoring, either passive or active, are ones that come up [as solutions].”* (KI 14 – RN). A limitation of active RMT mentioned was that individuals with dementia may have difficulties remembering to activate it *“...I think they don’t understand really what it’s for, maybe forget what it’s for.”* (KI 12 – DCP). An undesirable outcome for passive RMT mentioned for individuals with dementia was *“...these technologies could like bring on a sense of paranoia or bring on some behavioural and psychological symptoms of dementia for someone...oftentimes people talk about being watched, and we brush that off as being a sign of dementia. When in this case...It would be accurate.”* (KI 12 – DCP)

An additional situation where RMT may benefit a client is when there is a high risk of falls. *“This allows them... to stay at home with that peace of mind, especially their families to know if they’ve had a fall. That’s a big reason why people end up going to long term care sooner, is if they’ve had frequent falls, if they’re not safe at home.”* (KI 13 – DCP)

Finally, if a home care client lived alone RMT could be beneficial. Sometimes an older adult who is living independently is hesitant to get RMT, but the repercussions of not having the technology is illustrated by a story about a home care client from one of the technology providers, *“...he had a fall in the bathroom. Is there for a few hours before someone finds him. He goes into hospital...he came home... He’s got one of our medical alarms now because his family set him up with that.... I think he’s doing quite well... But just that reluctance, and then the inevitable thing happens...”* (KI 3 – TP). This type of situation was confirmed by a direct care provider who felt RMT was beneficial *“...if the person is all by themselves most of the time, or if the family comes and goes. Like they might be staying with a family member, and the family member might need to work.”* (KI 19 – DCP)

### **Theme 4: Issues related to older adults or their family/friend caregiver using RMT**

*Clients or caregiver knowledge and comfort with technology*

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Participants expressed that it was important for clients and their families to be educated about passive RMT. Also passive RMT *"...has to be user-friendly... as long as whatever technology is presented as whatever user-friendly is defined as, then I don't see any major concerns with the client interface."* (KI 10 – HCM). Interactions with non-profit organizations may be helpful if they *"...provide opportunities for families to learn and to understand and ask questions about the technology that's out there. And to connect with their peers, to connect with other families that have used it, to understand their experience and seek their advice."* (KI 1 – PM). Participants acknowledged that expecting clients and their families to search online for information was not reasonable due to digital literacy and comfort levels with technology *"...sometimes people are overwhelmed as it is, and to try to give them information about, 'Oh, just look online, you'll find it.'...for some people, that works... But some people are not used to using the Internet to search for things, don't even have Internet access..."* (KI 5 – DCP)

One of the resource navigators related a story about her husband who didn't *"...know how to turn on a computer. He has no interest to turn on a computer. And I'm a caregiver with my husband because he had several strokes when he was in his early 50s. And he's mobile and everything but his memory is... getting worse. So I don't know whether or not he could be trained at that level. But you have to have the knowledge in order to make it work, right."* (KI 20 – RN)

Additional barriers to installing passive RMT are when home care clients or their caregivers are not *"...able to read, they wouldn't hear, and the cost, and they may not have the level of education, or... their clinical diagnosis may impede their ability to use the devices."* (KI 4 – HCM). Passive RMT was sometimes viewed as *"... pretty fancy and pretty overwhelming to a senior who's not used to dealing with technology."* (KI 5 – DCP). This perception led to the observation that *"...people who have these devices are generally people that...are more computer savvy or they have more knowledge about technology, or they have family members who have the knowledge in order to use these devices."* (KI 4 – HCM). Therefore, participants felt it was important to explain the details of the monitoring and to ensure *"that the person who is the subject of that technology being used understands fully who has access to, for example, video cameras and the information on that and how it's going to be used."* (KI 1 – PM)

One way to facilitate this understanding is to *"have somebody who can come and sit and really just help them work it through."* (KI 11 – HCM). In response to this, two of the direct care pro-

viders felt it was their responsibility to monitor clients who had the active RMT alert necklace to make sure *"...they have it on...And explain to them how important that is..."* (KI 13 – DCP)

It was thought that *"...having local tech support would also be very helpful...But it needs to be local. It can't be somebody that's calling them remotely outside of the country or..."* (KI 4 – HCM). Other suggestions for improving the correct use of RMT was providing clients with some *"on-site training or...a visual aid that says 'don't forget to press your button if you've had a fall...'"* (KI 7 – HCM)

### RMT cost

The interview asked specifically about whether the cost of RMT created a barrier to accessing the technology. Several participants remarked that the income level of seniors in the area presented a barrier to them privately buying RMT *"...in this rural area, there are a lot of seniors that are below that income level..."* (KI 4 – HCM). This participant also remarked that *"...we [the health system] have limited resources that we can provide the funding for that. So those are the barriers."* (KI 4 – HCM)

Some participants suggested that some cost sharing should be considered by the health system *"making changes in the healthcare system so that these [RMT] become part of the services and the supports that are offered. Just like home support or just like homecare nursing. So that they can be built into that overall care plan."* (KI 1 – PM & KI 11 – HCM). One home care manager thought the cost of supporting RMT could be offset by the health system or caregiver not having to hire additional home support workers, *"...if more clients could afford the devices, that would help the primary caregivers and prevent them from caregiver breakdown. Because it is a 24-hour care. I mean statistically, it takes about three people [home support staff] to provide a 24-hour shift..."* (KI 4 – HCM). *"This thought was extended by one of the technology providers... So there's the immediate cost savings from...not having to put in the additional personal support workers because now you have technology ... with the delay to long term care, they're avoiding the cost."* (KI 18 – TP)

Even though participants frequently mentioned cost as a barrier to accessing RMT other barriers to using RMT may be more pertinent. A technology provider who had been able to get funding for *"...clients who are top priority, who need multiple daily visits from a homecare staff...and didn't have any sort of back-up plan in place..."* found that home care clients *"would not accept a free medical alarm...I think there's still that stigma, there's, I think, the reluctance to admit that they may be in a position of being, you*

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*know, not their younger, fitter, former self, and ...it's that admission of maybe failing health that people just don't want to confront... But it's not always the price.” (KI 3 – TP)*

In addition, even if financial support for buying RMT is provided it often depends on “...the knowledge and creativity of the people that are working with these individuals to present those things as options in that therapeutic interaction with the client...” (KI 11 – HCM)

## DISCUSSION

This study applied the CFIR implementation science framework to help explore multi-level factors that could affect the implementation of passive RMT into homecare settings from the perspectives of key informant stakeholders. Key informants in the study felt both passive and active RMT could benefit home care clients, their family/friend caregivers, and the health care system, and that it could keep clients out of long-term care, especially if paired with home support services. RMT could also comfort caregivers with the knowledge that the home care client was living safely in their home, which could reduce stress and help them maintain caregiving. They felt these benefits could potentially lead to a reduction in health system costs due to the associated reduction in older adults' use of acute, long-term, and home care services. This is supported by the following statistics. The percentage of Canadian healthcare expenditures for older adults in 2020 was 43.6% (Canadian Institute for Health Information, 2022) Across all ages hospital expenses in 2022 were the largest share of Canada's health expenditure, at 24.3%. The cost of long-term care or home care in Canada varies depending on the region and level of care. Long-term care in Canada can be as high as \$60,000 a year per person (Senior care access, 2020). Home care is partially funded, and long-term care is not funded, by the federal government. It is primarily covered by a mix of provincial and private funding. In the 2021-22 Nova Scotia budget \$1.02 billion was allocated for long-term care and home care (Keefe et al., 2022).

Having health providers or other trusted individuals who are knowledgeable about RMT, available to discuss the benefits, limitations, and how it might align with home care client and caregiver goals, would facilitate passive RMT implementation. The most significant barrier to implementing passive RMTs identified by participants was the lack of accessible information for home care clients and their caregivers about using passive RMTs. Having this information could increase their self-efficacy and reduce their anxiety about using novel health technologies. Both have been identified as significant barriers to adoption in

a recent literature review (Aranha et al., 2021). Because of policies that limit health professionals and resource navigators from discussing the use of passive RMT home care clients and their caregivers are left to investigate the suitability of passive RMT without assistance. Depending on their digital literacy, these restrictions could be a major barrier to individuals gathering information. Additionally, many participants felt the cost of passive RMT was a barrier. It was suggested that the health system consider cost-sharing with clients. However, cost-sharing necessitated making policy changes and some policymakers felt there was not enough evidence to make those changes.

To summarize, facilitators and barriers identified during the inductive coding aligned well with deductively coded CFIR domains and constructs identified as implementation determinants (Table 1). Participants comments indicated implementing passive RMT (CFIR Domain 1) could create a relative advantage for health systems (CFIR Domain 2) if it increased home care clients' ability to live safely at home while also reducing health system costs for home support services or admissions to long term care. However, to realize these cost benefits individual home care clients and their families often need to cover the cost of buying and setting up passive RMT systems (CFIR Domain 1). This was a potential barrier unless the health system could share costs. At the level of health professionals who would potentially recommend passive RMT to home care clients, there were barriers due to their lack of familiarity with passive RMT and their perceptions (CFIR Domain 3 and 4) that passive RMT was too complex (CFIR Domain 1) or technical for home care clients and their families to operate. These negative perceptions were offset by participants' positive perceptions that passive RMT could benefit home care clients and reduce the burden of caregiving on families (CFIR Domain 2 and 4). Current health system policies (CFIR Domain 2) that restricted health professionals from providing in-depth information were a significant barrier. Changing these policies may necessitate policymakers having more robust evidence of the health system's cost benefits (CFIR Domain 2). Alternatively, it might be mitigated by health systems networking with non-profit organizations that could share information (CFIR Domain 2). Finally, to implement passive RMT individuals at all levels of the health system need to be engaged in the process (CFIR Domain 5) of implementing passive RMT to increase their familiarity and knowledge of how passive RMT can best meet the needs of home care clients and their families.

Findings confirm and extend findings from the two prior qualitative studies conducted by the research group. They highlight the benefits caregiv-

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ers gain from monitoring their care recipient. Similar to (Read, Gagnon, et al., 2022), participants in this study also described institutional barriers to discussing passive RMT with home care clients, indicating other publicly funded home care systems may face similar barriers as those in Nova Scotia. However, the differences between this study and (Weeks et al., 2022) suggest health system representatives may perceive caregivers as less capable of negotiating the Internet to find information on passive RMT than caregivers themselves. Caregivers who had experience with the technology in the (Weeks et al., 2022) study did not identify similar barriers as those identified by the participants in this study. This may be due to the high educational level of participants in the study; almost 50% of the caregivers reported education levels of college or higher. Despite the contrast, the findings from this study align with the literature that supports training older adults about the internet to increase their digital literacy (Fields et al., 2021). In addition, caregiver perceptions regarding passive RMT may contribute to the different findings between the two studies. The literature has shown that when technology is perceived as being helpful caregivers are willing to adjust to using the technology (Moyle et al., 2022; Rosenberg & Nygard, 2012).

Other studies that examined the barriers and facilitators to implementing RMT confirm that major barriers to implementation are providers, health system managers, and policymakers' lack of awareness regarding what technologies are available to help older adults remain in their homes (Clark & McGee-Lennon, 2011). As previously highlighted, there is a need to increase awareness within the health system and community non-profit organizations about the benefits of various technologies, what funding is available to facilitate implementation, and how to identify which RMTs are in alignment with older adults' wishes and care needs (Peek et al., 2016). There is research demonstrating health professionals who introduce new technologies to older adults and their caregivers during home visits can improve caregiver knowledge and be cost-effective (Warner & Tipping, 2022). However, in-home training needs to be tailored to the preferred learning methods of the older adult (Liu & Joines, 2020), and health professionals need to be mindful of any negative attitudes they may have toward the older adult's ability to acquire the necessary technological knowledge (Alexopoulou, 2020).

There are acknowledged limitations to this study. Primarily this is a qualitative study with a small sample of participants from one Canadian province. Thus, the findings from this study cannot be generalized to the entire population of Canada. However, there were similar findings in the re-

search team's prior study conducted in a different province (Read, Gagnon, et al., 2022), this supports the possible transferability of findings from this study to other publicly funded home care systems. In addition, qualitative studies conducted by the research group included a range of participants including clients, caregivers, and stakeholders from the health system and non-profit organizations. Findings from the studies were consistent across different participants and settings.

Other limitations of the study may be the sampling method and the use of one interviewer. The snowball sampling employed may have resulted in a less diverse sample than using random sampling methods commonly used in quantitative studies that seek generalizability. Additionally, the use of snowball sampling may have been the reason our sample was predominantly female (Parker et al., 2019). The benefit of using snowball sampling was the study's ability to access individuals otherwise unknown to the researchers who provided insights that expanded an understanding of the resulting themes. Having one person conducting all the interviews may have led to personal biases undermining their ability to gather accurate information from participants. This limitation was mitigated by the continuity of having one experienced interviewer who could compare insights across participants and the thematic review process that engaged additional team members to challenge interim findings. In addition, information gathered from key informants was not personal nor contentious, this increased participant comfort during interviews and the probability of honest responses.

The research team has completed a PRCT examining the primary research question, whether providing passive RMT to frail older adults receiving home care services is effective at keeping them home longer. As outlined in the research team's published protocol (Donelle et al., 2020) quantitative data from an array of instruments were gathered from home care clients and their caregivers from two Canadian provinces. Participants either received usual home care services (control) or passive RMT in addition to usual home care (intervention). An analysis of this data will compare characteristics and outcomes between the intervention and control. This will provide more generalizable results on the benefits of passive RMT to home care clients and their family/friend caregivers. Additional large-scale research studies on passive RMT that assess health system costs are needed to determine whether providing passive RMT to home care clients can lead to health care system cost benefits.

## CONCLUSION

Applying an evidence-based implementation framework during our analysis helped identify

possible recommendations for publicly funded home care systems considering implementing passive RMT. The recommendations are for systems to identify and address the individual and health system barriers related to knowledge and beliefs about passive RMT. Addressing these barriers through education and training could increase stakeholder awareness of the benefits and limitations of passive RMT to identify where

it can be best utilized. It is recommended that non-profit organizations disseminate information on passive RMT either through their resource navigators or on their websites to help inform clients and their caregivers. It is also recommended that health systems review the recent literature on passive RMT with different client populations to inform future policy changes.

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